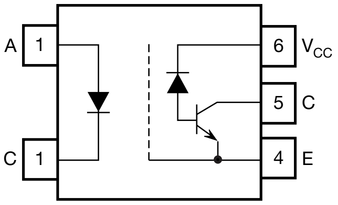
Automotive High Speed Coupler, High Noise Immunity, 1 MBd, SOP-5 Package

DESCRIPTION

The VOMHA43A is the automotive high speed optocoupler, consists of a GaAlAs infrared emitting diode, optically coupled with an integrated photo detector and a high speed transistor. The photo detector is junction isolated from the transistor to reduce miller capacitance effects. The open collector output function allows circuit designers to adjust the load conditions when interfacing with different logic systems such as TTL, CMOS, etc.

Because the VOMHA43A has a Faraday shield on the detector chip, it can also reject and minimize high input to output common mode transient voltages.

The VOMHA43A, ideal solution for automotive communication bus isolation, for CAN, LIN, I2C or SPI, as well as isolated drive circuit applications such as IPM (intelligent power module) drivers.



FEATURES

- AEC-Q102 automotive qualified
- -40 °C to +125 °C wide temperature range
- Very high common mode transient immunity of 50 000 V/μs
- Open collector output
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free
e3
RoHS
COMPLIANT
HALOGEN
FREE
GREEN
(5-2008)

APPLICATIONS

- Automotive communication bus interface (CAN, LIN, I^2C, SPI)
- Automotive IPM driver
- Ground signal isolation
- Logic voltage level translation

AGENCY APPROVALS

- UL1577 (pending)
- cUL (pending)
- CQC (pending)
- DIN EN 60747-5-5 (VDE 0884-5) available with option 1 (pending)

ORDERING INFORMATION

V	O	M	H	A	4	3	-	X	0	0	#	T
PART NUMBER								PACKAGE OPTION				TAPE AND REEL

AGENCY CERTIFIED / PACKAGE	
UL, cUL, CQC	
SOP-5	VOMHA43AT
UL, cUL, CQC, VDE (option 1)	
SOP-5	VOMHA43A-X001T

Note

- The product is available only on tape and reel

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
INPUT				
Reverse voltage		V_R	7	V
DC forward current		I_F	30	mA
Surge forward current	$t_p \leq 1$ µs, 300 pulses/s	I_{FSM}	1	A
Power dissipation	$T_{amb} \leq 70$ °C	P_{diss}	80	mW
OUTPUT				
Supply voltage		V_S	-0.5 to +30	V
Output voltage		V_O	-0.5 to +20	V
Output current		I_O	8	mA
Power dissipation	$T_{amb} \leq 70$ °C	P_{diss}	100	mW
COUPLER				
Storage temperature range		T_{stg}	-55 to +150	°C
Ambient temperature range		T_{amb}	-40 to +125	°C
Junction temperature		T_j	140	°C
Soldering temperature (1)	t < 10 s max.		260	°C

Notes

- Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operational sections of this document. Exposure to absolute maximum ratings for extended periods of the time can adversely affect reliability.

(1) Refer to reflow profile for soldering conditions for surface mounted devices (SMD). Refer to wave profile for soldering conditions for through-hole devices (DIP).

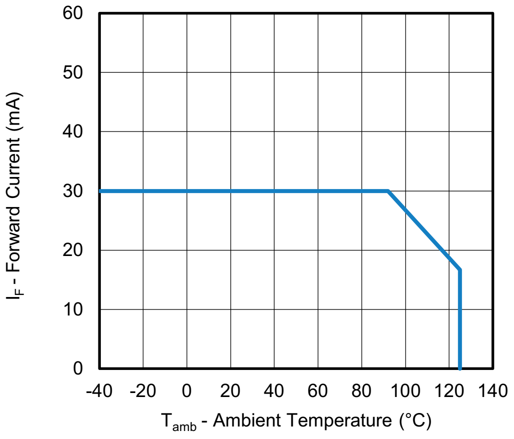


Fig. 1 - Forward Current vs. Ambient Temperature

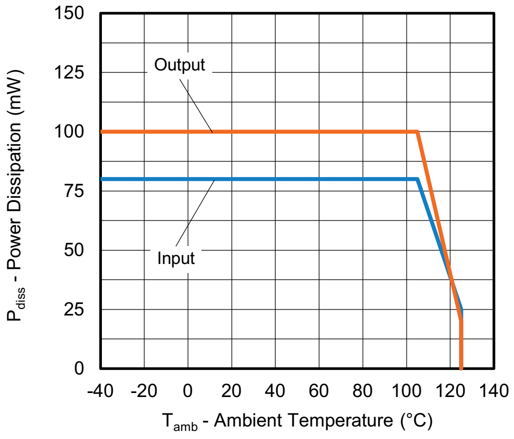


Fig. 2 - Power Dissipation vs. Ambient Temperature

ELECTRICAL CHARACTERISTICS (T_{amb} = -40 °C to +125 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
INPUT						
Input forward voltage	I_F = 10 mA	V_F	1.1	-	1.7	V
	I_F = 10 mA, T_{amb} = 25 °C		1.2	1.38	1.6	
Input reverse current	V_R = 5 V	I_R	-	0.001	10	µA
Input capacitance	f = 1 MHz, V_F = 0 V, T_{amb} = 25 °C	C_{IN}	-	30	-	pF
Temperature coefficient of forward voltage	I_F = 1.5 mA	$\Delta V_F/\Delta T_{amb}$	-	-1.4	-	mV/°C
	I_F = 10 mA		-	-0.9	-	
OUTPUT						
Logic low supply current	I_F = 10 mA, V_O = open, V_{CC} = 20 V	I_{CCL}	-	350	650	µA
	I_F = 1.5 mA, V_O = open, V_{CC} = 20 V	I_{CCL}	-	50	-	µA
Logic high supply current	I_F = 0 mA, V_O = open, V_{CC} = 20 V, T_{amb} = 25 °C	I_{CCH}	-	0.01	1	µA
	I_F = 0 mA, V_O = open, V_{CC} = 20 V	I_{CCH}	-	0.01	2.5	µA
Logic low output voltage	I_F = 10 mA, V_{CC} = 4.5 V, I_O = 2.4 mA	V_{OL}	-	0.1	0.5	V
	I_F = 1.5 mA, V_{CC} = 4.5 V, I_O = 0.5 mA	V_{OL}	-	0.1	-	V
	I_F = 0.8 mA, V_{CC} = 4.5 V, I_O = 0.2 mA	V_{OL}	-	0.1	-	V
Logic high output current	I_F = 0 mA, V_O = V_{CC} = 5.5 V, T_{amb} = 25 °C	I_{OH}	-	0.1	0.5	µA
	I_F = 0 mA, V_O = V_{CC} = 20 V	I_{OH}	-	0.1	5	µA
COUPLER						
Capacitance (input-output) (1)	f = 1 MHz, T_{amb} = 25 °C	C_{IO}	-	0.4	-	pF

Notes

- Minimum and maximum values are testing requirements. Typical values are characteristics of the device and are the result of engineering evaluation. Typical values are for information only and are not part of the testing requirements. All typical values are measured at T_{amb} = 25 °C.

(1) A 0.1 µF bypass capacitor connected between pins 4 and 6 is recommended.

CURRENT TRANSFER RATIO (T_{amb} = -40 °C to +125 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
Current transfer ratio (1)	V_{CC} = 4.5 V, V_O = 0.4 V, I_F = 10 mA, T_{amb} = 25 °C	CTR	32	85	100	%
	V_{CC} = 4.5 V, V_O = 0.4 V, I_F = 10 mA		24	85	-	
	V_{CC} = 4.5 V, V_O = 0.4 V, I_F = 1.5 mA		33	105	-	
	V_{CC} = 4.5 V, V_O = 0.4 V, I_F = 0.8 mA		25	92	-	

Notes

- Minimum and maximum values are testing requirements. Typical values are characteristics of the device and are the result of engineering evaluation. Typical values are for information only and are not part of the testing requirements. All typical values are measured at T_{amb} = 25 °C.

(1) A 0.1 µF bypass capacitor connected between pins 4 and 6 is recommended.

SWITCHING CHARACTERISTICS (T_{amb} = -40 °C to +125 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
Propagation delay time to logic low at output (see fig. 1) (1)	V_{CC} = 5 V, I_F = 10 mA, R_L = 1.9 kΩ, T_{amb} = 25 °C	t_{PHL}	0.07	0.11	0.8	µs
	V_{CC} = 5 V, I_F = 10 mA, R_L = 1.9 kΩ		0.06	-	1	µs
	V_{CC} = 5 V, I_F = 1,5 mA, R_L = 10 kΩ		-	0.7	5	µs
	V_{CC} = 5 V, I_F = 0,8 mA, R_L = 27 kΩ		-	1.1	10	µs
Propagation delay time to logic high at output (see fig. 1) (1)	V_{CC} = 5 V, I_F = 10 mA, R_L = 1.9 kΩ, T_{amb} = 25 °C	t_{PLH}	0.15	0.25	0.8	µs
	V_{CC} = 5 V, I_F = 10 mA, R_L = 1.9 kΩ		0.03	0.25	1	µs
	V_{CC} = 5 V, I_F = 1,5 mA, R_L = 10 kΩ		-	0.9	5	µs
	V_{CC} = 5 V, I_F = 0,8 mA, R_L = 27 kΩ		-	2.1	10	µs
Pulse width distortion	V_{CC} = 5.0 V, I_F = 10 mA, R_L = 1.9 kΩ, T_{amb} = 25 °C	PWD	-	0.15	0.45	µs
	V_{CC} = 5.0 V, I_F = 10 mA, R_L = 1.9 kΩ		-	0.15	0.85	µs
Propagation delay difference between any 2 parts	V_{CC} = 5.0 V, I_F = 10 mA, R_L = 1.9 kΩ, T_{amb} = 25 °C	PDD	-	0.3	0.5	µs
	V_{CC} = 5.0 V, I_F = 10 mA, R_L = 1.9 kΩ		-	0.3	0.9	µs

Notes

- Minimum and maximum values are testing requirements. Typical values are characteristics of the device and are the result of engineering evaluation. Typical values are for information only and are not part of the testing requirements. All typical values are measured at T_{amb} = 25 °C.

(1) The 1.9 kΩ load represents 1 TTL unit load of 1.6 mA and the 5.6 kΩ pull-up resistor.

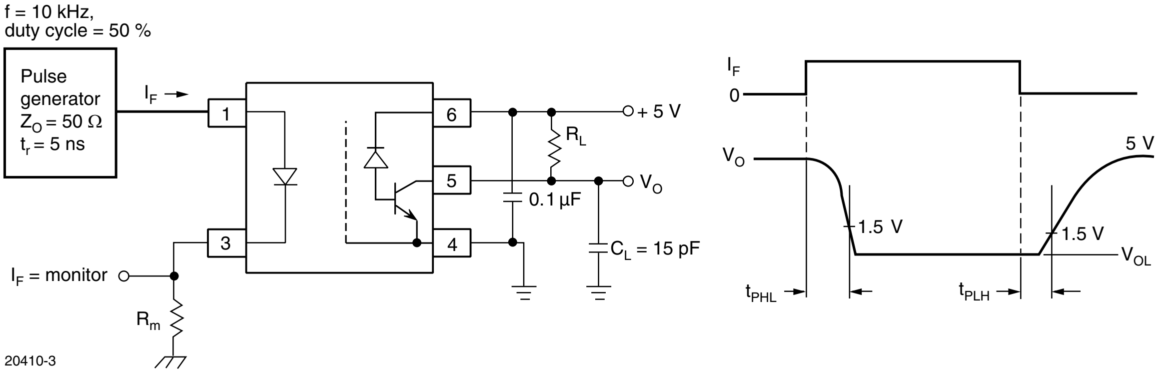


Fig. 3 - Test Circuit for Switching Times

COMMON MODE TRANSIENT IMMUNITY (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
Common mode transient immunity at logic high level output (see fig. 2 and notes 1, and 2)	R_L = 1.9 kΩ, I_F = 0 mA, V_{CM} = 1500 V_{P-P}	$\lvert CM_H \rvert$	40 000	50 000	-	V/µs
Common mode transient immunity at logic low level output (see fig. 2 and notes 1, and 2)	R_L = 1.9 kΩ, I_F = 10 mA, V_{CM} = 1500 V_{P-P}	$\lvert CM_L \rvert$	40 000	50 000	-	V/µs
Common mode transient immunity at logic high level output (see fig. 2 and notes 1, and 2)	R_L = 10 kΩ, I_F = 0 mA, V_{CM} = 1500 V_{P-P}	$\lvert CM_H \rvert$	-	10 000	-	V/µs
Common mode transient immunity at logic low level output (see fig. 2 and notes 1, and 2)	R_L = 10 kΩ, I_F = 1.5 mA, V_{CM} = 1500 V_{P-P}	$\lvert CM_L \rvert$	-	10 000	-	V/µs

Notes

(1) Common mode transient immunity in a logic high level is the maximum tolerable (positive) dV_{CM}/dt on the leading edge of the common mode pulse (V_{CM}) to assure that the output will remain in a logic high state (i.e., V_O > 2 V). Common mode transient immunity in a logic low level the maximum tolerable (negative) dV_{CM}/dt on the trailing edge of the common mode pulse signal (V_{CM} to assure that the output will remain in logic low state, i.e., V_O > 0.8 V).

(2) The 1.9 kΩ load represents 1 TTL unit load of 1.6 mA and the 5.6 kΩ pull-up resistor.

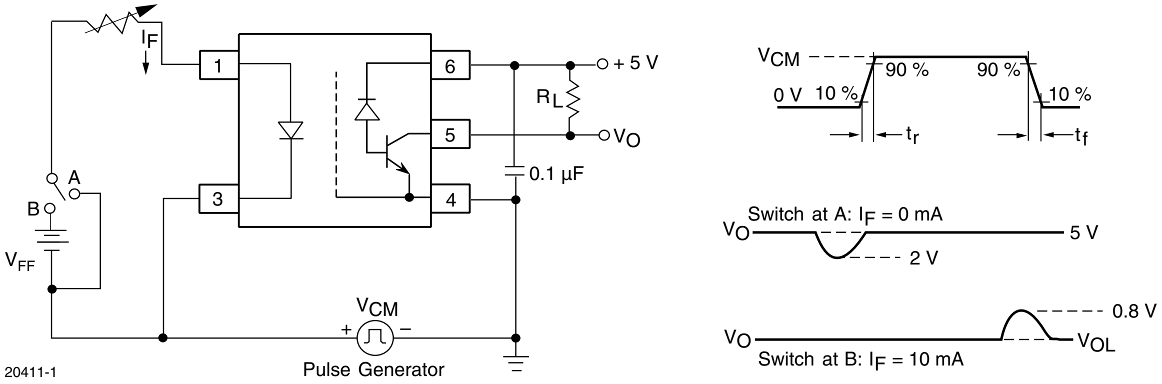


Fig. 4 - Test Circuit for Transient Immunity and Typical Waveforms

SAFETY AND INSULATION RATINGS (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
Climatic classification	According to IEC 68 part 1		40 / 125 / 21	
Pollution degree	According to DIN VDE 0109		2	
Comparative tracking index	Insulation group II	CTI	400	
Maximum rated withstanding isolation voltage	According to UL1577, t = 1 min	V_{ISO}	4000	V_{RMS}
Maximum transient isolation voltage	According to DIN EN 60747-5-5	V_{IOTM}	6000	V_{peak}
Maximum repetitive peak isolation voltage	According to DIN EN 60747-5-5	V_{IORM}	707	V_{peak}
Isolation resistance	T_{amb} = 25 °C, V_{IO} = 500 V	R_{IO}	$\geq 10^{12}$	Ω
	T_{amb} = 100 °C, V_{IO} = 500 V	R_{IO}	$\geq 10^{11}$	Ω
Output safety power		P_{SO}	350	mW
Input safety current		I_{SI}	150	mA
Input safety temperature		T_S	175	°C
Creepage distance			≥ 5	mm
Clearance distance			≥ 5	mm
Insulation thickness		DTI	≥ 0.4	mm

Note

- As per IEC 60747-5-5, § 5.5.4.9.3, this optocoupler is suitable for “safe electrical insulation” only within the safety ratings. Compliance with the safety ratings shall be ensured by means of protective circuits.

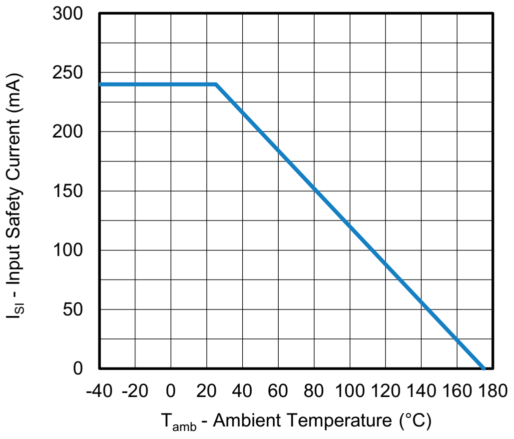


Fig. 5 - Input Safety Current vs. Ambient Temperature

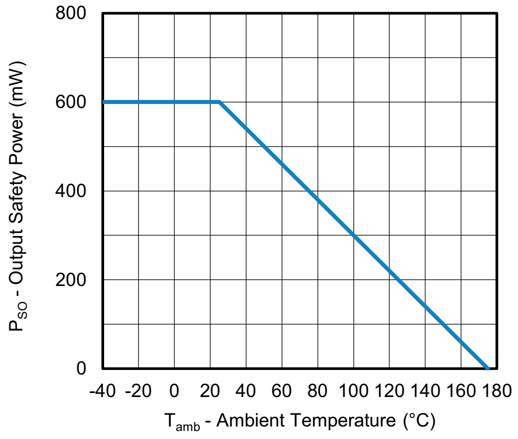


Fig. 6 - Output Safety Power vs. Ambient Temperature

TYPICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

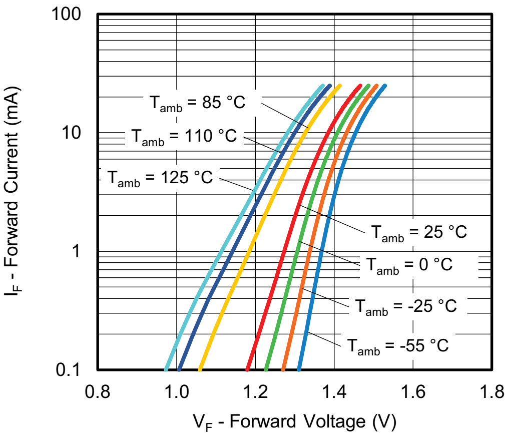


Fig. 7 - Forward Current vs. Forward Voltage

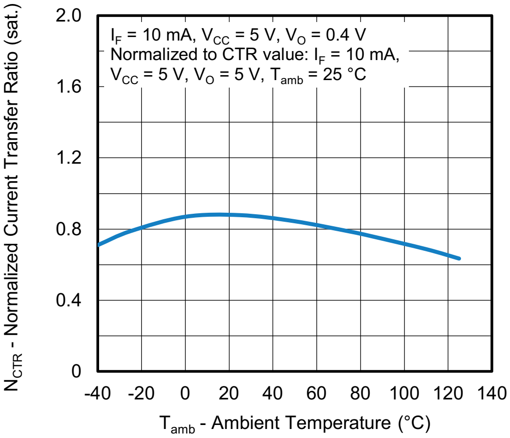


Fig. 10 - Normalized Current Transfer Ratio (saturated) vs. Ambient Temperature

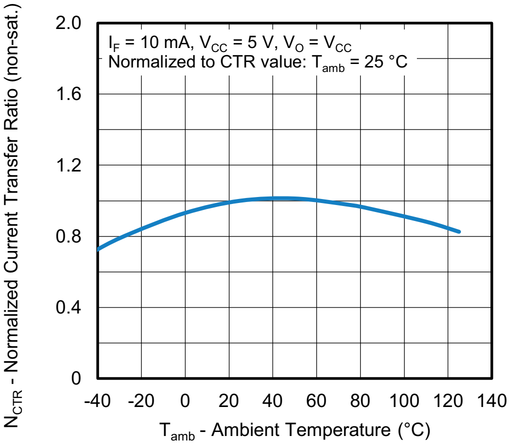


Fig. 8 - Normalized Current Transfer Ratio (non-saturated) vs. Ambient Temperature

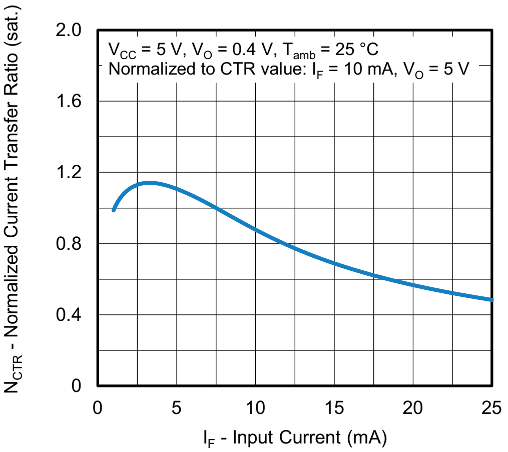


Fig. 11 - Normalized Current Transfer Ratio (non-saturated) vs. Input Current

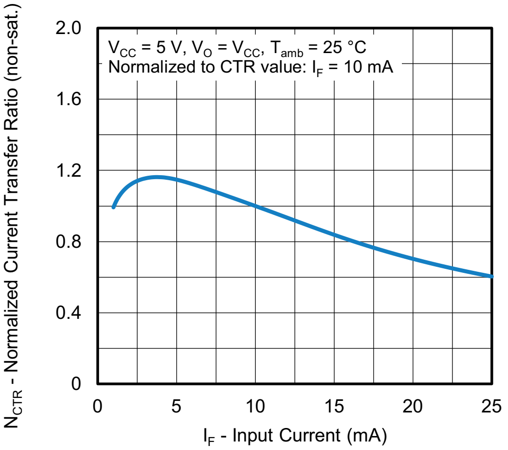


Fig. 9 - Normalized Current Transfer Ratio (non-saturated) vs. Input Current

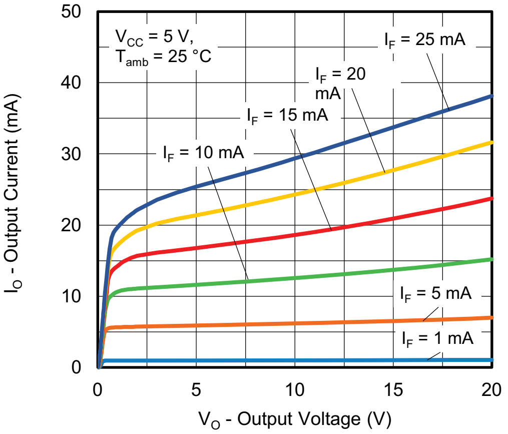


Fig. 12 - Output Current vs. Output Voltage

For technical questions, contact: optocoupleranswers@vishay.com

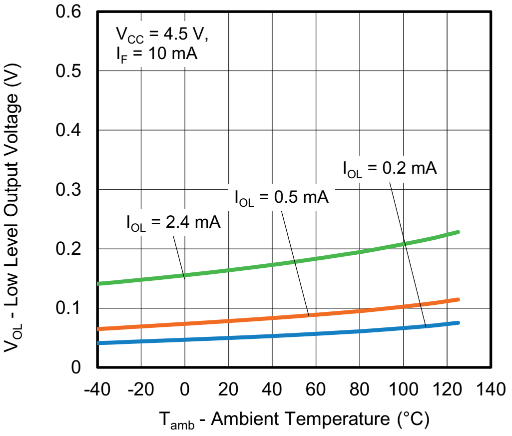


Fig. 13 - Low Level Output Voltage vs. Ambient Temperature

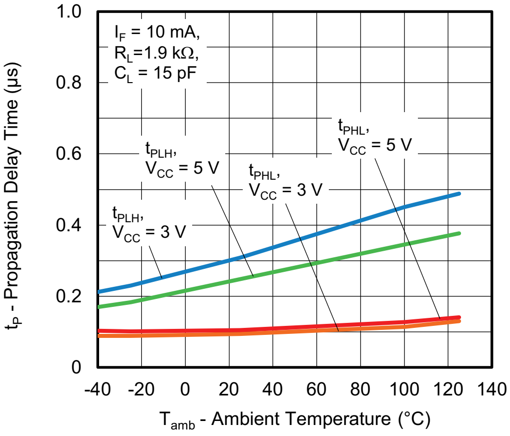


Fig. 16 - Propagation Delay Time vs. Ambient Temperature

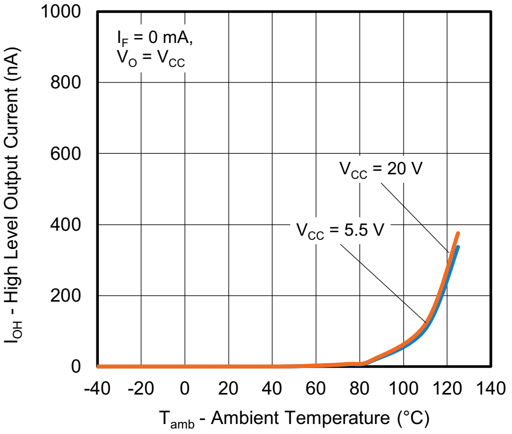


Fig. 14 - High Level Output Current vs. Ambient Temperature

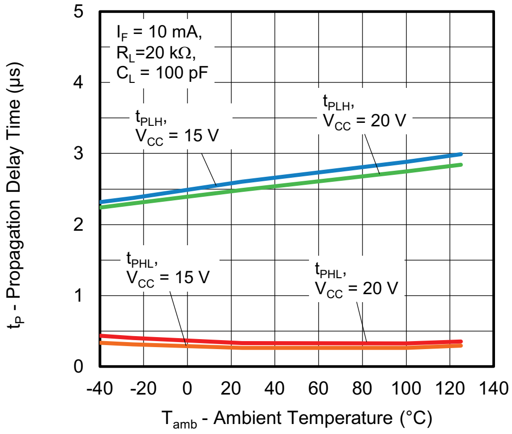


Fig. 17 - Propagation Delay Time vs. Ambient Temperature

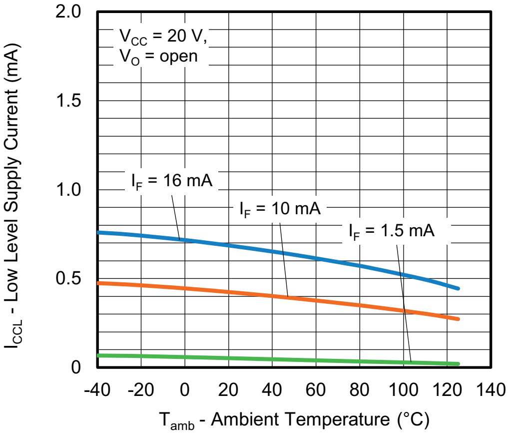


Fig. 15 - Low Level Supply Current vs. Ambient Temperature

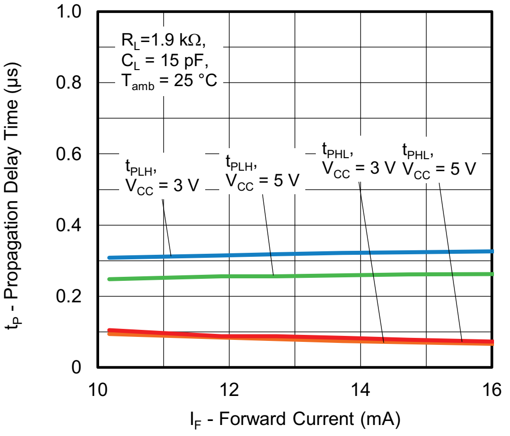


Fig. 18 - Propagation Delay Time vs. Forward Current

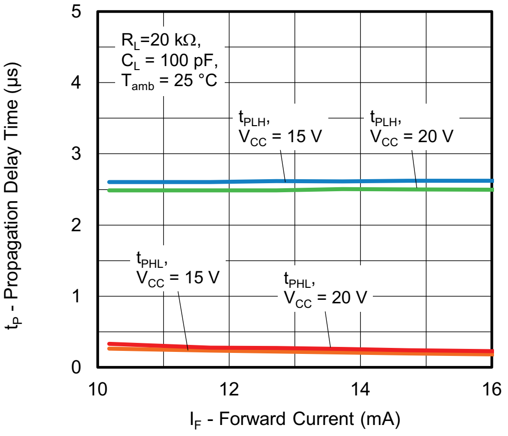


Fig. 19 - Propagation Delay Time vs. Forward Current

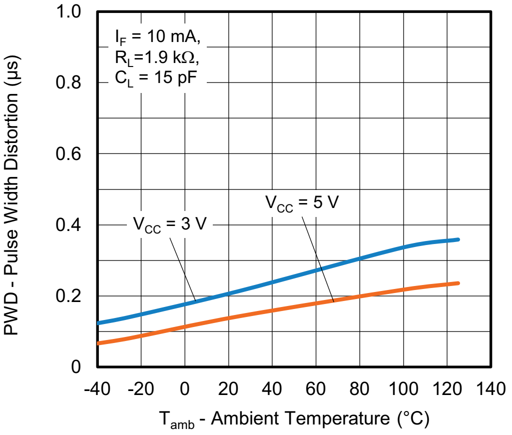


Fig. 20 - Pulse Width Distortion vs. Ambient Temperature

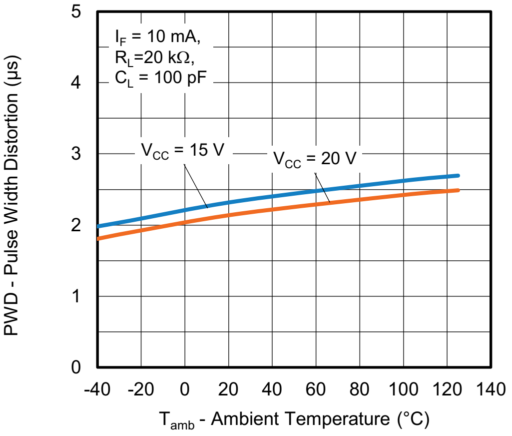


Fig. 21 - Pulse Width Distortion vs. Ambient Temperature

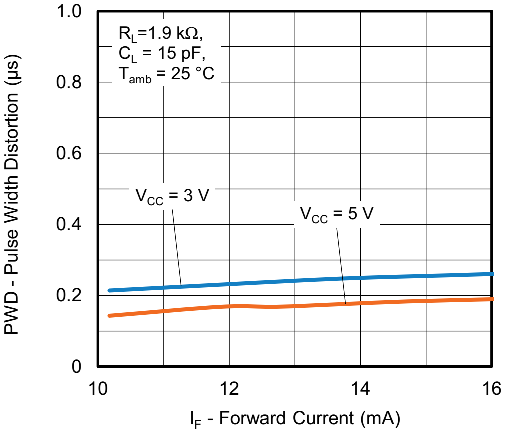


Fig. 22 - Pulse Width Distortion vs. Forward Current

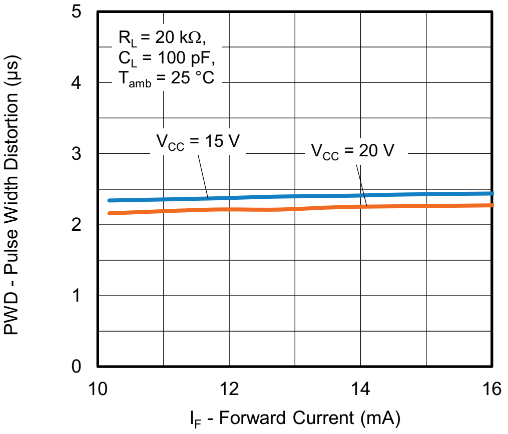


Fig. 23 - Pulse Width Distortion vs. Forward Current

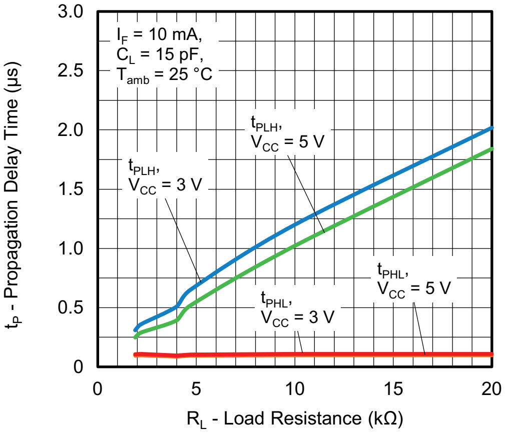


Fig. 24 - Propagation Delay Time vs. Load Resistance

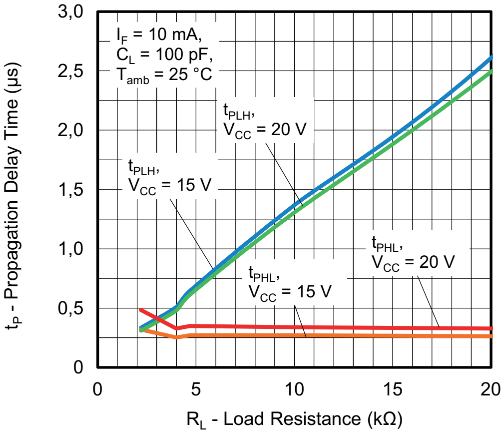


Fig. 25 - Propagation Delay Time vs. Load Resistance

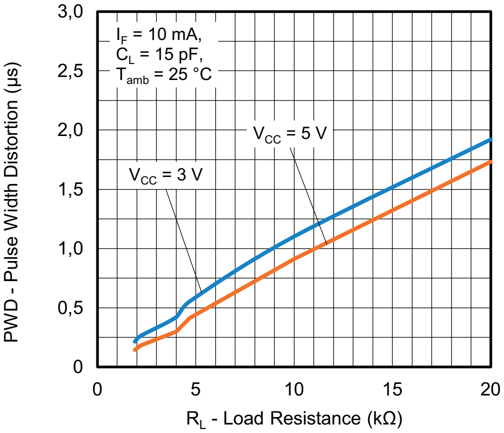


Fig. 26 - Pulse Width Distortion vs. Load Resistance

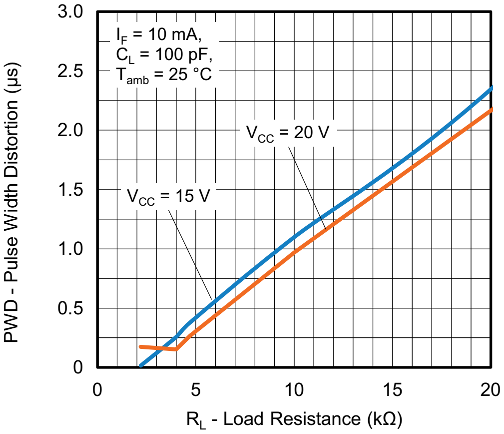
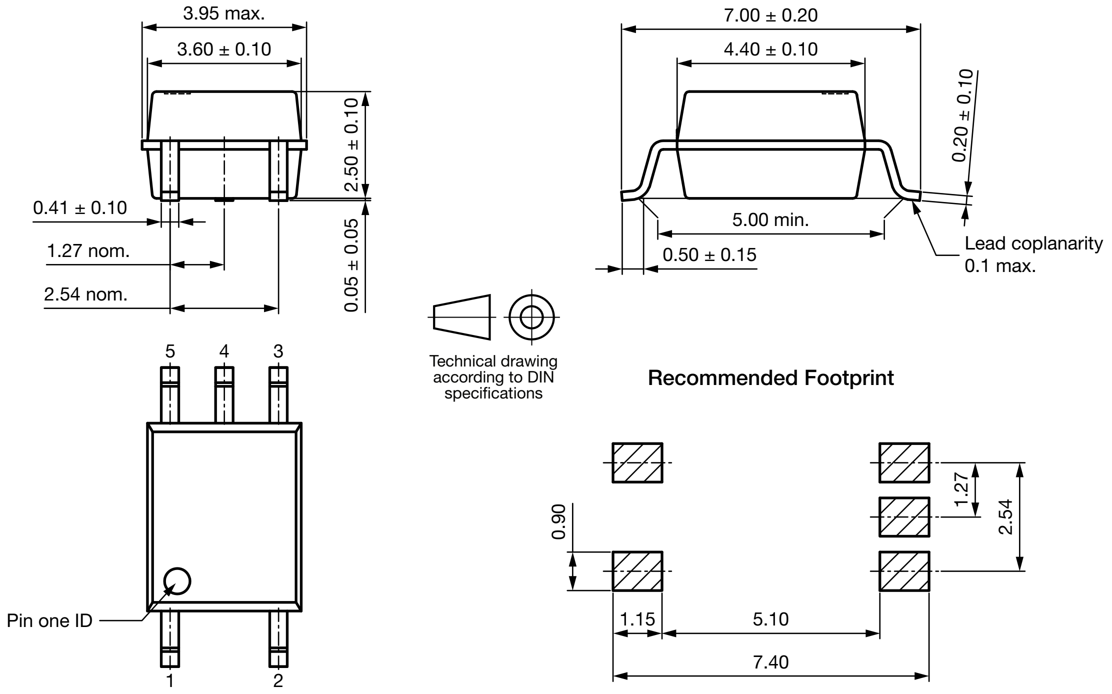


Fig. 27 - Pulse Width Distortion vs. Load Resistance

PACKAGE DIMENSIONS (in millimeters)



PACKAGE MARKING

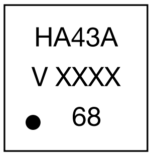


Fig. 28 - Example of VOMHA43AT

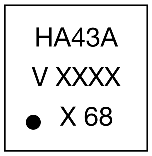


Fig. 29 - Example of VOMHA43AT-X001T

Notes

- XXXX = LMC (lot marking code)
- VDE logo is not part of the package marking
- VDE (option 1) is reflected in the package marking with the character "X"
- Tape and reel suffix (T) is not part of the package marking

PACKING INFORMATION (tape and reel)

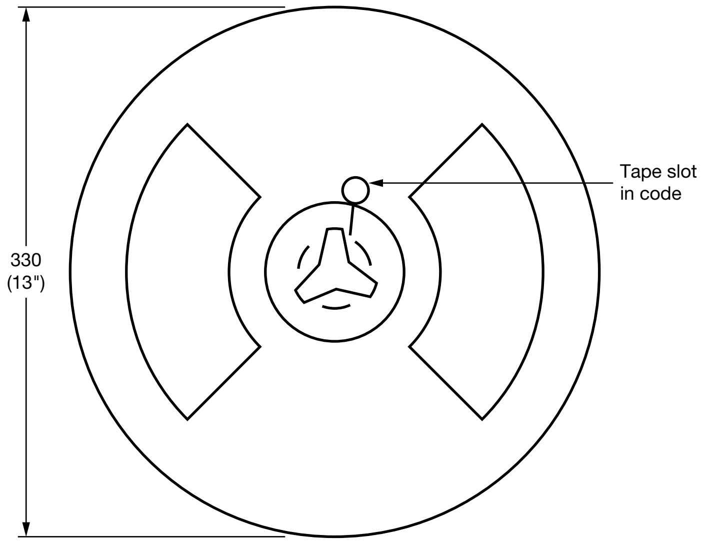


Fig. 30 - Tape and Reel Shipping Medium

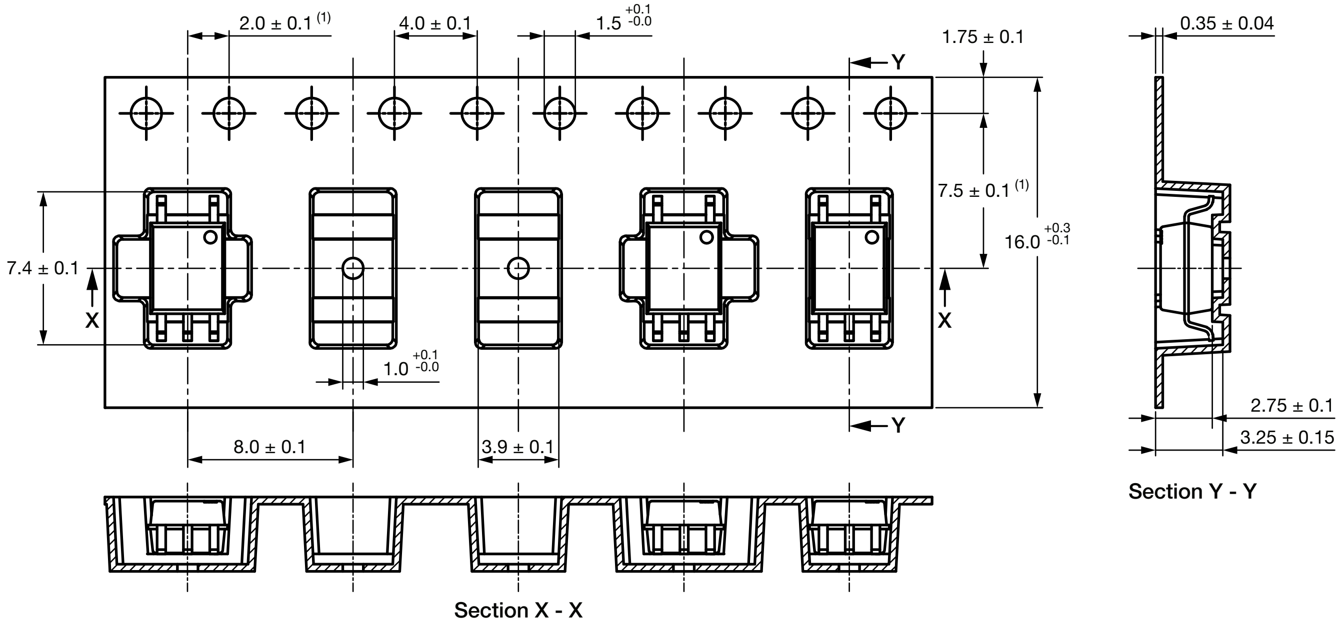


Fig. 31 - Tape and Reel Packing (2000 pieces on reel)

Notes

- Cumulative tolerance of 10 sprocket holes is ± 0.20

(1) Measured from centerline of sprocket hole to centerline of pocket

SOLDER PROFILE

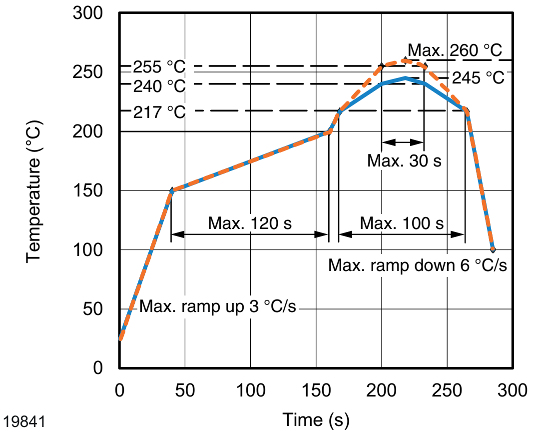


Fig. 32 - Lead (Pb)-free Reflow Solder Profile According to J-STD-020

HANDLING AND STORAGE CONDITIONS

ESD level: HBM class 2

Floor life: unlimited

Conditions: $T_{amb} < 30$ °C, RH < 85 %

Moisture sensitivity level 1, according to J-STD-020

REVISION HISTORY

DATASHEET VERSION	REVISION DATE	CHANGE
1.0	20-Feb-2026	Initial datasheet release

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